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KANSAS ENVIRONMENTAL AND RESOURCE STUDY:
A GREAT PLAINS MODEL

REVISION - Supersedes Prior Report for this Period

Interpretation and Automatic Image Enhancement Facility

R. M. Haralick
Remote Sensing Laboratory
Center for Research, Inc.
Space Technology Center
University of Kansas
Lawrence, Kansas 66044

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Report Prepared by: K. Shanmugan
Sam Shanmugan
Research Associate

Report Approved by: R. M. Haralick
R. M. Haralick
Principal Investigator

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| 16. Abstract This report summarizes the results of our efforts to provide data processing support for ERTS investigators in Kansas. Programs have been developed for data retrieval, feature extraction and classification of digital MSS data. The IDECS/PDP-15 facility at the University of Kansas Remote Sensing Laboratory has been used for quick look analysis of ERTS imagery. Programs have been developed for studying fresh water bodies in ERTS imagery over Kansas on the IDECS. | | | | | |
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Preface

The main objective for the ERTS data processing facility is to provide the opportunity to use the analog and digital processing available at the University of Kansas for all ERTS investigators in Kansas. The work under these task consists of (1) developing user oriented digital software package for processing digital MSS data and (2) developing analog/digital package for processing transparencies of ERTS imagery on all IDECS/PDP-15 facility. During the report period ending January 31, 1973, we have developed a set of computer programs to convert the NASA supplied CCT's to a format acceptable to the HW635, to extract selected blocks of data from the digital tapes, to access a given target area relative to a set of landmarks and to classify MSS data into categories of interest. In addition, we have completed a set of programs to equal probability quantize the transparencies of ERTS images on the IDECS, to display the color coded image on a TV screen and a program to analyze the water bodies in ERTS images. The programs we have developed are currently used by investigators of tasks 3, 4 and 5 of NASA Contract No. NAS5-21822. Based on the results of our efforts, we recommend that interactive processing on the IDECS/PDP facility be used for quick look analysis of ERTS images and for detailed processing of selected frames we recommend all digital processing on the digital computer.

TABLE OF CONTENTS

| | <u>Pages</u> |
|---|--------------|
| I. INTRODUCTION | 1 |
| II. DIGITAL DATA RETRIEVAL AND CLASSIFICATION PROGRAMS | 1 |
| III. SOFTWARE DEVELOPMENT FOR PROCESSING ERTS IMAGERY ON IDECS | 2 |
| IV. NEW TECHNOLOGY | 3 |
| V. PROGRAM FOR NEXT REPORT PERIOD. | 3 |
| VI. CONCLUSIONS | 3 |
| VII. RECOMMENDATIONS | 4 |

I. INTRODUCTION

The purpose of this report is to summarize the work done during the period August 1972-January 31, 1973 under NASA contract no. NAS5-21822, task 2. The main objective of this task is to provide data processing support facility for ERTS investigators in Kansas. The following programs in a user oriented data processing program package have been completed during the report period:

- (1) a program to convert the NASA supplied digital MSS data to a format acceptable to our computer (HW635)
- (2) a retrieval program to locate an object perceived on an ERTS-1 MSS image on the digital tapes.
- (3) a program to locate targets relative to a set of land marks on the digital tape.
- (4) a set of programs to classify features of MSS data
- (5) a program to equal probability quantize and display the color coded digital image on the IDECS
- (6) a program to analyze water bodies in ERTS imagery on the IDECS/PDP facility .

Details of the purpose and use of these programs are given in the following sections of this report.

II. DIGITAL DATA RETRIEVAL AND CLASSIFICATION PROGRAMS

The digital data retrieval program package consists of several programs designed to help ERTS investigators to extract digital MSS data for the target areas of interest. The first step in processing digital MSS data is to convert data on the NASA supplied digital tapes to a format in which the data can be accessed on the HW635 in FORTRAN callable routines. A multiple entry subroutine has been developed for this purpose to convert lines of data on ERTS CCT's to 36 bit words and arrange them in point form. This subroutine also reads the ID and annotation blocks on the tapes and returns the length of the variable length scan line. A set of subroutines have been developed to process the digital data after it has been converted to the proper format. These

subroutines access the digital data for selected target areas after they have been perceived on the MSS image transparency. The coordinates of the target area on the image transparency is inputted and the program extracts the digital data for the target area and prints out a digital picture of the target area for detailed analysis. Another subroutine in the package has been designed for repetitive location of targets relative to a set of previously identified landmarks. This subroutine, with minor modifications can also be used for registering the digital images in a temporal sequence.

In addition to the data retrieval programs, a software package for implementing two classification algorithms has also been completed during the report period. The algorithms which have been implemented are the Bayes rule and a piece wise linear discriminant function method for classifying multidimensional vectors. The programs in the digital software package are currently used by investigators of tasks 3, 4 and 5 of this contract

III. SOFTWARE DEVELOPMENT FOR PROCESSING ERTS IMAGERY ON IDECS

In addition to developing software for processing digital MSS data, we have also developed and tested a set of programs to process the ERTS MSS transparencies on the IDECS/PDP-15 facility. One of the programs in this package digitizes the ERTS black and white MSS transparencies and quantizes the digital data into 8 or 16 equal probability intervals. The quantized data is then color coded and displayed on the IDECS TV monitor for detailed analysis. Since the human eye can perceive color tones better than grey tones, the color display is very useful for distinguishing between various categories of interest which may not be easily identified on the black and white transparency.

Another set of programs have been developed for analyzing water bodies present in ERTS imagery. These programs generate and map an arbitrary number of contours across a given waterbody, whose outline has been obtained by establishing a binary map of the waterbody on MSS band seven image which provides high contrast between waterbodies and land. These programs have been extensively used by ERTS

investigators monitoring fresh water resources in Kansas. The results of their studies may be found in several reports which have been submitted for entry in ERTS data base.

IV. NEW TECHNOLOGY

None

V. PROGRAM FOR NEXT REPORT PERIOD

Besides providing data processing support for ERTS investigators in Kansas, the participants of this module will continue to develop user oriented software packages. Attempts will be made towards:

- (1) developing a digital algorithm for registering the digital MSS data in a temporal sequence
- (2) developing a digital algorithm for enhancing boundaries for easy location of fields for crop studies
- (3) developing an algorithm for identifying crop types from digital MSS data. This algorithm will be used by the investigators of the agriculture statistics module
- (4) developing additional software for processing ERTS image transparencies on the IDECS.

VI. CONCLUSIONS

Based on the results of our efforts during this report period we conclude that the IDECS/PDP-15 type interactive facility is adequate for quick look analysis of large volumes of ERTS imagery. For accurate, detailed analysis, we conclude that all digital processing is appropriate.

VII. RECOMMENDATIONS

We recommend the use of interactive facility like IDECS for quick scanning of large volumes of black and white ERTS MSS transparencies and the use of digital processing for detailed and accurate analysis of selected frames of MSS images.